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FORAGE PLOT HARVESTER^{1/}

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Forage breeding research requires the harvesting of a large number of plots for each test. To reduce the weather and growth variables, all plots must be harvested as quickly as possible. This requires several men. A typical procedure in harvesting using a sickle-bar mower, requires six men employed as follows: One man driving the tractor on which the mower is mounted; one man raking the cut material onto the holding pan; two men carrying and weighing; one man recording weights and keeping the weighing jack near the plot being cut; and one man taking moisture samples. Since only the center section of each plot is used for yield determinations, an additional operation with another mower is required to cut and remove the side sections.

FUNCTIONAL REQUIREMENTS

The following requirements were established to guide the design of a forage plot harvester better suited to breeding research. This harvester must:

- (1) Be maneuverable for small-plot operation;
- (2) Be easily and completely cleaned between plots;
- (3) Be efficiently operated by a maximum of three men;
- (4) Be able to harvest the entire plot width; approximately six feet, but keep the 2-foot-wide center section accurately separated for yield determination.

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DESCRIPTION AND OPERATION

A conventional 6-foot cutter bar, 3-point hitch, power-take-off driven sickle mower was used as the base for the forage plot harvester. This mower allows the entire plot to be harvested in one operation. Since only the center 2 feet are to be used in yield determinations, the sheet-metal dividers shown in figure 1 were mounted on the cutterbar. The one on the end is to



Figure 1. Front view of forage plot harvester.

keep forage from collecting on the end support.

A 4-foot-diameter reel consisting of four paddles was mounted above the cutterbar to keep the cut grass swept clear. Power was transmitted to the reel by a sheave mounted on the mower drive shaft, through V-belts and a 1:1 right-angle gear box. A ground speed of $1\frac{3}{4}$ -miles per hour allows the men on foot to perform their tasks at a reasonable pace and keep up with the harvester. Since this rate is 154 feet per minute, a reel speed of $13\frac{1}{4}$ r.p.m. was selected. This gives a velocity of approximately 166 feet per minute at the outer diameter of the reel. Thus, the relative velocity between the reel and the grass being cut is about 12 feet per minute, which is sufficient to keep the cutterbar clear. The mower drive shaft has a speed of 540 r.p.m., making a 40.7:1 reduction necessary. This speed was reduced by using a 2-inch-diameter sheave on the drive, a 15-inch-diameter sheave on the input to the right-angle drive, a $2\frac{3}{4}$ -inch-diameter sheave on the output to the right-angle drive, and a 15-inch-diameter sheave on the reel shaft. The distance from the drive sheave to right-angle drive is 36 inches, consequently

no belt tighteners are required. Since only 18 inches separate the sheave on the right-angle drive from the reel sheave, a spring-loaded idler was installed to insure a good contact of the belt on the small sheave.

Because of the lightweight construction and the flexing of the cutterbar as it is raised, four bearings were used on the reel shaft. The shaft, made from 3/4-inch tubing, is supported by pillow block bearings, mounted on 1 1/4-inch-square tubing at the ends. The inner bearings are mounted on 2- by 1/4-inch flat steel bars. The inner bearing supports also serve as a mounting for the sheet metal dividers.

Immediately behind the center section of the blade, a piece of sheet metal, curved to a 24-inch radius, is mounted. One-inch-wide canvas webbing is reveted to the edges of each reel slat in this section. As the reel turns, the material from the center section is swept up the curved surface and deposited in a 6-cubic-foot weighing pan, which is equipped with a bail.

The material on either side of the center pan is swept back onto a platform. These platforms, extending back 3 feet, are made from sheet metal, supported by a 1 1/2- by 1 1/2- by 1/8-inch angle iron. Skid shoes formed by the same size angle iron support the weight of the platforms and grass. The approximately 6-square-foot area on each platform will hold the grass from each plot. Later the material on each of these, along with the weighed material, is piled in the alleyways for removal.

The scale is mounted on a piece of 3/4-inch pipe, mounted on the mower base and bent so the scale will be suspended directly above the weighing pan. The grass from the center section, or yield area, which is all collected in the pan, can be weighed by lifting the pan vertically to the scale (fig. 2). The scale is rotated so the tractor driver can read and record the weight.

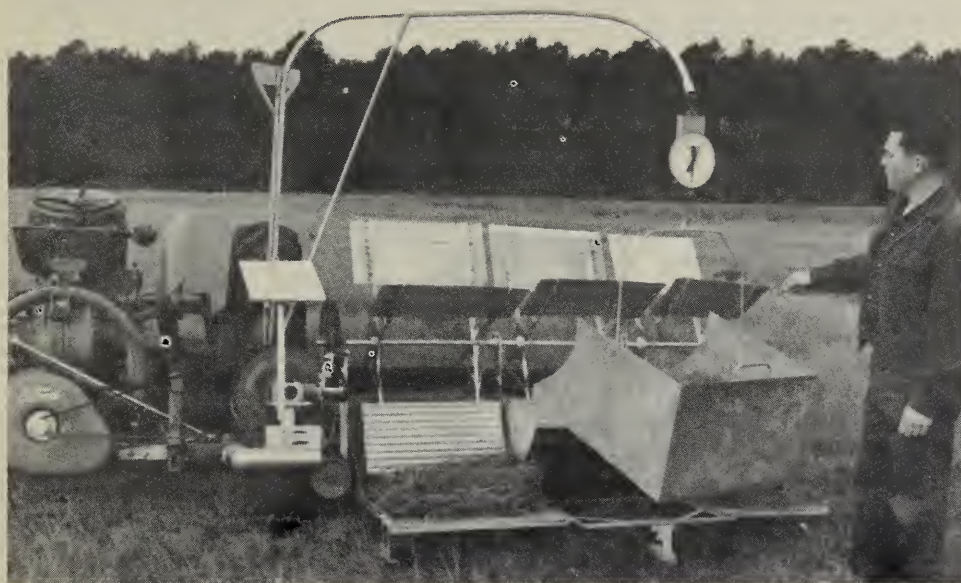


Figure 2. Rear view of forage plot harvester showing weighing pan and scale.

In operation, three men are normally used. The first man drives the tractor and reads and records the weight; the second man puts the weighing pan on the scale, empties it, and rakes the harvested material from outside the yield area off the holding platforms into the alleyways; and, the third man collects the moisture samples from the pan after the contents have been weighed. The harvester performs well in grass shorter than 18 inches. When grass is more than 2 feet tall, considerable wrapping on the reel may occur.

With this forage plot harvester, three men do the work formerly done by six and do it in less time.